

IN THE CLAIMS

The following claim set replaces all prior versions, and listings, of claims in the application.

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c' 1. (Currently Amended) A flow amount measuring apparatus comprising:  
a fluid temperature detector for detecting a fluid temperature;  
a heater<sup>70</sup> controllable to a reference temperature which is either one of a fixed temperature and a variable temperature responsive to the fluid temperature detected by the fluid temperature detector;  
a flow amount<sup>70</sup> detector disposed at only ~~either~~ one of an upstream side and a downstream side of the heater with respect to a direction of fluid flow and changes its temperature in response to the fluid flow amount and the fluid flow direction; and  
detecting means for detecting the fluid flow amount variable with the fluid flow direction from the temperature detected by the fluid amount detector.

2. (Original) A fluid amount measuring apparatus of claim 1, wherein:  
the detecting means is for producing an output corresponding to a difference between the temperature detected by the fluid amount detector and a fixed temperature.

3. (Original) A flow amount measuring apparatus of claim 1, wherein:

the detecting means is for producing an output corresponding to a difference between the temperature detected by the fluid amount detector and the temperature detected by the fluid temperature detector.

4. (Original) A flow amount measuring apparatus of claim 1, wherein:

the flow amount detector is disposed upstream the heater with respect to a forward direction of a fluid flow;

the detecting means is for producing an output varying in dependence on the fluid flow in the forward direction and in a reverse direction when the temperature detected by the flow amount detector is lower and higher than a predetermined temperature, respectively, and varying in dependence on a temperature difference between the predetermined temperature and the temperature detected by the flow amount detector.

5. (Original) A flow amount measuring apparatus of claim 1, wherein:

the flow amount detector is disposed downstream the heater with respect to the forward direction of a fluid flow;

the detecting means is for producing an output varying in dependence on the fluid flow in a reverse direction and in the forward direction when the temperature detected by the flow amount detector is lower and higher than a predetermined

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temperature, respectively, and varying in dependence on a temperature difference between the predetermined temperature and the temperature detected by the flow amount detector.

6. (Original) A flow amount measuring apparatus of claim 1, wherein:

a temperature of the heater at one of an upstream side and a downstream side and another of the upstream side and the downstream side is lower and higher than the reference temperature, respectively.

7. (Original) A flow amount measuring apparatus of claim 1, wherein:

the flow amount detector is disposed to be capable of detecting a temperature which is lower and higher than the reference temperature when the fluid flow is in a direction from the flow amount detector to the heater and in a direction from the heater to the flow amount detector, respectively.

8. (Original) A flow amount measuring apparatus of claim 1, wherein:

the heater includes a strip which turns at a plurality of points to have a total width larger than that of the fluid temperature detector and the fluid amount detector in the fluid flow direction.

9. (Original) A flow amount measuring apparatus of claim 1, further comprising:

a substrate on which the fluid temperature detector, the fluid amount detector and the heater are formed, the substrate having a cavity underneath the fluid temperature detector.

10. (Original) A flow amount measuring apparatus of claim 1, further comprising:

a substrate on which the fluid temperature detector, the fluid amount detector and the heater are formed, the substrate having slits at the upstream side of the flow amount detector and the downstream side of the heater.

Claim 11 (Canceled).

12. (Currently Amended) A flow amount measuring apparatus of claim 11  
comprising:

a substrate;

a heater formed on the substrate and controllable to a first reference

temperature;

a first temperature detector formed on the substrate at a position upstream of the  
heater;

a second temperature detector formed on the substrate at a position close to the  
heater, said second temperature detector being disposed at one of the upstream and  
downstream sides of the heater; and

21  
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a control circuit connected to the heater, the first temperature detector and the second temperature detector and including a heater control part and a flow amount measuring part, the first temperature detector being for detecting a first temperature and connected to at least one of the heater control part and the flow amount measuring part, the second temperature detector being connected to the flow amount measuring part, and the flow amount measuring part producing an output varying with a difference between a second temperature detected by the second temperature detector and a second reference temperature and with a flow direction of fluid passing along the substrate;

~~wherein:~~ wherein the first temperature detector is connected to the heater control part so that the first reference temperature of the heater is controlled to vary with the first temperature detected by the first temperature sensor; and the second reference temperature is fixed.

13. (Currently Amended) A flow amount measuring apparatus comprising:

a substrate;

a heater formed on the substrate and controllable to a first reference temperature;

a first temperature detector formed on the substrate at a position upstream of the heater;

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a second temperature detector formed on the substrate at a position close to the heater, said second temperature detector being disposed at one of the upstream and downstream sides of the heater; and

a control circuit connected to the heater, the first temperature detector and the second temperature detector and including a heater control part and a flow amount measuring part, the first temperature detector being for detecting a first temperature and connected to at least one of the heater control part and the flow amount measuring part, the second temperature detector being connected to the flow amount measuring part, and the flow amount measuring part producing an output varying with a difference between a second temperature detected by the second temperature detector and a second reference temperature and with a flow direction of fluid passing along the substrate;

~~wherein:~~ wherein the first temperature detector is connected to the second temperature detector so that the second temperature detected by the second temperature detector is corrected by the first temperature detected by the first temperature detector.

14. (Currently Amended) A flow amount measuring apparatus of claim 1244,  
wherein:

the heater has a width in a direction of fluid flow which is larger than that of the second temperature detector.

15. (Currently Amended) A flow amount measuring apparatus of claim 1244,  
wherein:

the substrate has cavities at locations underneath the first temperature detector,  
the heater and the second temperature detector.

16. (Currently Amended) A flow amount measuring apparatus of claim 1244,  
wherein:

the substrate has a slit formed between the second temperature detector and the  
heater.

17. (Previously Added) A flow amount measuring apparatus as in claim 1  
wherein:

said heater has a total width larger than that of the fluid temperature detector and  
the fluid amount detector in a fluid flow direction, and

said flow amount detector is disposed in closer proximity to the heater than is the  
fluid temperature detector with respect to fluid flow direction.

18. (Currently Amended) A flow amount measuring apparatus as in claim 1244  
wherein:

said heater has a total width larger than that of the fluid temperature detector and  
the fluid amount detector in a fluid flow direction, and

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said flow amount detector is disposed in closer proximity to the heater than is the fluid temperature detector with respect to fluid flow direction.

19. (Currently Added) A fluid flow amount and direction measuring apparatus comprising:

a flowing fluid temperature detector disposed in a fluid flow passage;

a controllable heater also disposed in said fluid flow passage;

a fluid flow detector disposed at only one of an upstream side and ~~or downstream side~~ of said controllable heater and providing a temperature dependent resistance that is a predetermined function of both fluid flow amount and fluid flow direction.

20. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

means for producing an output signal corresponding to the difference between the temperature of said fluid flow detector and a fixed temperature.

21. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

means for producing an output signal corresponding to the difference between the temperature of said fluid flow detector and the detected flowing fluid temperature.

22. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 wherein the fluid flow detector is disposed upstream of the heater with respect to a forward direction of fluid flow and further comprising:

output means is for producing an output signal varying in a dependence on fluid flow in a forward direction and in a reverse direction when the temperature detected by the fluid flow detector is lower and higher than a predetermined temperature, respectively, and varying in dependence on temperature difference between the predetermined temperature and a temperature detected by the fluid flow detector.

23. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 wherein the fluid flow detector is disposed downstream of the heater with respect to a forward direction of fluid flow; and further comprising:

output means for producing an output signal varying in dependence on fluid flow in a reverse direction and in a forward direction when the temperature detected by the fluid flow detector is lower and higher than a predetermined temperature, respectively, and varying in dependence on a temperature difference between the predetermined temperature and a temperature detected by the fluid flow detector.

24. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 wherein:

the heater temperature at one upstream/downstream side and the other downstream/upstream side is lower/higher than the reference temperature, respectively.

25. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 wherein:

the flow detector is disposed to detect a temperature which is (a) lower and (b) higher than the reference temperature when the fluid flow is (a) in a direction from the flow amount detector to the heater and (b) in a direction from the heater to the flow amount detector, respectively.

26. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 wherein:

the heater includes a strip which turns at a plurality of points to have a total width larger than that of the fluid temperature detector and the fluid flow detector in a fluid flow direction.

27. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

a substrate on which the fluid temperature detector, the fluid flow detector and the heater are formed, the substrate having a cavity underneath the fluid temperature detector.

28. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 19 further comprising:

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a substrate on which the fluid temperature detector, the fluid flow detector and the heater are formed, the substrate having slits at the upstream side of the flow detector and the downstream side of the heater.

29. (Previously Added) A fluid flow amount and direction measuring apparatus comprising:

a substrate;

a controllable heater formed on the substrate;

a first temperature detector formed on the substrate at a position upstream of the heater;

a second temperature detector formed on the substrate at a position closer to the heater than the first temperature detector, said second temperature detector being disposed at one of the upstream and downstream sides of the heater; and

a control circuit connected to the heater, the first temperature detector and the second temperature detector and including a heater control part and a flow amount measuring part,

the first temperature detector being controlled to detect a first temperature and connected to at least one of the heater control part and the flow amount measuring part,

the second temperature detector being connected to the flow amount measuring part, and

the flow amount measuring part producing an output signal varying as a function of (a) the difference between a temperature detected by the second temperature detector and a reference temperature and (b) the flow direction of fluid passing along the substrate.

30. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the first temperature detector is connected to the heater control part so that the heater is controlled to vary its temperature with the temperature detected by the first temperature sensor; and

the reference temperature is fixed.

31. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the first temperature detector is connected to the second temperature detector so that the temperature detected by the second temperature detector is corrected by the temperature detected by the first temperature detector.

32. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the heater has a width in a direction of fluid flow which is larger than that of the second temperature detector.

33. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the substrate has cavities at locations and underneath the first temperature detector, the heater and the second temperature detector.

34. (Previously Added) A fluid flow amount and direction measuring apparatus as in claim 29 wherein:

the substrate has a slit formed between the second temperature detector and the heater.

35. (Currently Amended) A fluid flow amount and direction measuring method comprising:

detecting flowing fluid temperature in a fluid flow passage;  
controlling the temperature of a heater also disposed in said fluid flow passage;  
detecting fluid flow at only one of an a-location-upstream location and or  
downstream location of said controllable heater and providing a temperature dependent resistance that is a predetermined function of both fluid flow amount and fluid flow direction.

36. (Previously Added) A fluid flow amount and direction measuring method as in claim 35 further comprising:

producing an output signal corresponding to the difference between the detected temperature of said fluid flow and a fixed temperature.

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37. (Previously Added) A fluid flow amount and direction measuring method as in claim 35 further comprising:

producing an output signal corresponding to the difference between the temperature at the location of detecting fluid flow and the detected flowing fluid temperature.

38. (Previously Added) A fluid flow amount and direction measuring method as in claim 35 wherein the fluid flow detection location is disposed upstream of the heater with respect to a forward direction of fluid flow and further comprising:

producing an output signal varying in dependence on fluid flow in a forward direction and in a reverse direction when the temperature at the location of fluid flow detection is lower and higher than a predetermined temperature, respectively, and varying in dependence on temperature difference between the predetermined temperature and a temperature detected at the location of the fluid flow detection.

39. (Previously Added) A fluid flow amount and direction measuring method as in claim 35 wherein the fluid flow detection location is disposed downstream of the heater with respect to a forward direction of fluid flow and further comprising:

21  
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producing an output signal varying in dependence on fluid flow in a reverse direction and in a forward direction when the temperature at the location of fluid flow detection is lower and higher than a predetermined temperature, respectively, and varying in dependence on temperature difference between the predetermined temperature and a temperature detected at the location of the fluid flow detection.

40. (Previously Added) A fluid flow amount and direction measuring method as in claim 35 wherein:

the heater temperature at one upstream/downstream side and the other downstream/upstream side is lower/higher than the reference temperature, respectively.

41. (Previously Added) A fluid flow amount and direction measuring method as in claim 35 wherein:

the flow detection location is disposed to detect a temperature which is (a) lower and (b) higher than the reference temperature when the fluid flow is (a) in a direction from the location of flow amount detection to the heater and (b) in a direction from the heater to the location of flow amount detection, respectively.

42. (Previously Amended) A fluid flow amount and direction measuring method as in claim 35 further comprising:

using a fluid temperature detector, fluid flow detector and heater formed on a substrate having a cavity underneath the fluid temperature detector.

43. (Previously Added) A fluid flow amount and direction measuring method as in claim 35 further comprising:

using a fluid temperature detector, fluid flow detector and heater formed on a substrate having slits at the upstream side of the flow detector and the downstream side of the heater.

44. (Previously Added) A fluid flow amount and direction measuring method comprising:

forming a controllable heater on a substrate,  
forming a first temperature detector on the substrate at a position upstream of the heater;  
forming a second temperature detector on the substrate at a position closer to the heater than the temperature detector, said second temperature detector being disposed at one of the upstream and downstream sides of the heater; and  
controlling the first temperature detector to detect a first temperature;  
connecting the second temperature detector to a flow amount measuring circuit,  
and  
producing an output signal varying as a function of (a) the difference between a temperature detected by the second temperature detector and a reference temperature and (b) the flow direction of fluid passing along the substrate.

45. (Previously Added) A fluid flow amount and direction measuring method as in claim 44 wherein:

the heater is controlled to vary its temperature with the temperature detected by the first temperature sensor; and

the reference temperature is fixed.

46. (Previously Added) A fluid flow amount and direction measuring method as in claim 44 wherein:

the temperature detected by the second temperature detector is corrected by the temperature detected by the first temperature detector.

47. (Previously Added) A fluid flow amount and direction measuring method as in claim 44 wherein:

the substrate has cavities at locations underneath the first temperature detector, the heater and the second temperature detector.

48. (Previously Amended) A fluid flow amount and direction measuring method as in claim 44 further comprising:

forming a slit in the substrate between the second temperature detector and the heater.

49. (New) A flow amount measuring apparatus of claim 13, wherein:  
the heater has a width in a direction of fluid flow which is larger than that of the second temperature detector.

50. (New) A flow amount measuring apparatus of claim 13, wherein:  
the substrate has cavities at locations underneath the first temperature detector, the heater and the second temperature detector.

51. (Currently Amended) A flow amount measuring apparatus of claim 13, wherein:  
the substrate has a slit formed between the second temperature detector and the heater.

52. (New) A flow amount measuring apparatus as in claim 13 wherein:  
said heater has a total width larger than that of the fluid temperature detector and the fluid amount detector in a fluid flow direction, and  
said flow amount detector is disposed in closer proximity to the heater than is the fluid temperature detector with respect to fluid flow direction.

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